REMARKS

Introduction

The Examiner has rejected claims 1, 2, 7, 8, 12, 20, 21 and 23 under 35 U.S.C. § 103(a) over U.S. Patent No. 5,881,172 to Pintsov (hereinafter Pintsov). Claims 19 and 22 were rejected under 35 U.S.C. 103(a) as being unpatentable over Pintsov in view of Shimuzu et al., U.S. Patent No. 6,038,343 (hereinafter Shimuzu). Claims 13-15, 17, 24 and 25 were rejected under 35 U.S.C. 103(a) as being unpatentable over Pintsov in view of Crane et al., U.S. Patent No. 4,531,231 (hereinafter Crane). Claims 16, 18, 26 and 27, as well as claims 3-6 and 9-11 were rejected under 35 U.S.C. 103(a) as being unpatentable over Pintsov in view of Crane, and further in view of Guo et al. "Classification trees with neural network feature extraction," Proceedings IEEE Computer Society Conference on Computer Vision and Pattern Recognition, June 1992 (hereinafter Guo). Additionally, claims 1-27 were rejected under 35 U.S.C 112, first paragraph. Applicants respectfully traverse these rejections. For the reasons discussed in detail below, all of the pending claims are in condition for allowance.

Prior Art Rejections

I. Pintsov fails to disclose or suggest claim limitations

In the following, applicants provide an overview of their invention and of Pintsov and then discusses their differences. Applicants' technique relates to recognizing chirographs in a computer system by using a primary classifier and secondary classifiers to yield a high probability in character recognition. A primary recognizer is provided for

converting chirographs to code points or shape indexes, and secondary recognizers are developed and trained to differentiate chirographs which produce selected code points. The output of training data from a primary recognizer may be used to construct secondary recognizers for each code point supported by the system. Using the training data, the primary recognizer returns a code point to a sorting process to sort the chirographs and actual code points into various files. Note that if other types of shape indexes are being used, the chirographs are similarly sorted into files for each shape index based on the shape index returned by the primary recognizer. A secondary recognizer may then be constructed for each of the files so that a secondary recognizer exists for each code point (or shape index) supported by the system. If the secondary recognizer has only one possible output that is the same code point as output by the primary recognizer, or actually reduces recognition accuracy with respect to the primary recognizer's output, such a secondary recognizer may be discarded in applicants' technique since it does not improve recognition of the chirograph. Such a sorting process automatically discovers any chirographs that the primary recognizer tends to confuse and secondary recognizers constructed for each of these files are then inherently able to better distinguish any chirographs that the primary recognizer tends to confuse.

Once the recognition mechanism including the secondary recognizers are developed, the recognition mechanism may be used to recognize a chirograph. The recognition mechanism in applicants' technique may submit the chirograph to the primary recognizer and receives a code point (or shape index) from the primary recognizer. If a code point, then the code point may then be used to determine if the code point has a secondary recognizer associated with it. If not, the primary recognizer's returned code

point is returned by the recognition mechanism as the returned code point. However, if a secondary recognizer is associated with the code point received from the primary recognizer, the chirograph is submitted to the secondary recognizer. The code point returned by the selected secondary recognizer is returned as the returned code point. Furthermore, a plurality of secondary recognizers can be associated with a single character in applicants' technique. For example, a first CART tree can be provided as a secondary process for differentiating two-stroke "A"-shaped characters, and a second, distinct CART tree for differentiating three-or-more-stroke "A"-shaped characters.

Although CART trees have been attempted for handwriting recognition and have been rejected because they are unable to make reliable decisions from among large numbers of characters, the use of CART trees as a secondary recognition mechanism in applicants' technique has been thoroughly tested, and for certain confusion pairs advantageously has a 99.7 percent accuracy rate. The 0.3 percent error rate is believed to result from characters too poorly written even for humans to discern, and in fact is comparable to the recognition error rate of humans.

Pintsov relates to a technique for hierarchical character recognition. Pintsov describes a hierarchy of specialist classifiers, each configured to recognize characters belonging to distinct ambiguity classes. A suspicious character may belong to a distinct ambiguity class based on apparent size, the type of character, level of gray in the image of the character, styles of handwriting, prior knowledge that a character candidate has been surgically separated from an adjoining character, or upon assignment of a character candidate by the universal classifier to a predefined character group known to be ambiguous. Ptinsov first applies a universal classifier system to input image data and

identifies "suspicious" characters. A suspicious character may be identified by the universal classifier system making an assignment of the character to a predefined character group known to be ambiguous. For a suspicious character identified, the input image data is then applied to a specialist classifier that is designed to handle a well-defined set of recognition cases. The specialist classifiers are not designed to process characters of other shapes. A classifier of this kind is trained only on a large set of characters that belong to a specific ambiguity class.

In Pintsov's technique, image data is applied to a universal classifier system which can comprise one or more universal classifiers known in the art. For unambiguous data, the universal classifier system outputs a character code. If the universal classifier system determines that a candidate character for the input data is "suspicious", then the universal classifier system selects a "specialist" classifier based upon the probable identity of the candidate character. The specialist classifier applies a recognition algorithm tailored to the candidate character and outputs a probable character code. The specialist classifier may use feature extraction algorithms such as neural networks and syntactic or linguistic algorithms, nearest neighbor algorithms and other algorithms known in the art of character recognition.

Significantly, Pintsov does not describe a primary recognizer able to provide a shape index without making any decision as to whether that chirograph is of a set of easily confused chirographs, as generally recited in applicants' claims. Nor does Pintsov describe creating a secondary classifier for each code point output by training data from a primary recognizer, as in applicants' technique. Rather, Pintsov describes specialist classifiers configured to recognize characters belonging to predefined ambiguity classes

and a universal classifier system that first determines that a character candidate does not belong to a predefined ambiguity class before outputting the character candidate. As described, a group of characters belonging to a predefined ambiguity class are used to identify whether a candidate character is a suspicious character. Each specialist classifier is trained or built to distinguish only differences between characters belonging to distinct ambiguity classes. A suspicious character may belong to a distinct ambiguity class based on apparent size, the type of character, level of gray in the image of the character, styles of handwriting, or upon assignment of a character candidate by the universal classifier to a predefined character group known to be ambiguous.

In Pintsov's technique, a universal classifier first outputs a probable identity of a candidate character and the universal classifier system then makes a determination as to whether the character is suspicious. In one example described in Pintsov, such a determination may be made by checking whether the candidate character belongs to a predefined character group known to be ambiguous. In such a case, Pintsov describes that a character may be pre-programmed to belong to a predefined character group known to be ambiguous when it is known to be mistaken for another character within that same ambiguity class, (e.g. "4" and "9"). Thus to determine whether a candidate character is suspicious, the candidate character may be compared to any pre-programmed characters belonging to a predefined character group known to be ambiguous. However, nowhere in Pintsov is there a description of a universal classifier outputting a character without making any decision as to whether that chirograph is of a set of easily confused chirographs.

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The following table lists the elements of claim 1 and the prior art sections upon which the Examiner has relied as allegedly disclosing those elements.

	Claim 1 Element	Prior Art
A.	providing a primary recognizer for converting chirographs to shape indexes, the primary recognizer providing output including a shape index when a chirograph is input thereto	... The invention first applies a universal classifier system (which may comprise one or more universal classifiers) to input image data, and identifies "suspicious" characters . ... (Pintsov, 2:7-34, 2:28-54, 2:21, 2:34-35)
B.	providing a plurality of secondary recognizers to convert chirographs into code points, and associating the secondary recognizers with at least some of the shape indexes	... the invention employs a hierarchy of "specialist classifiers, each configured to recognize characters belonging to distinct ambiguity classes. ... ...If the character is suspicious, a specialist classifier for the suspicious character is selected. ... (Pintsov, 3: 16-18, 4:10-14, 3:18-21)
C.	receiving a chirograph	... automated recognition of machine-printed or handwritten characters. ... (Pintsov, 1:10-11)
D.	providing the chirograph to the primary recognizer and receiving a shape index therefrom, the primary recognizer providing the shape index without making any decision as to whether that chirograph is of a set of easily confused chirographs	... or upon assignment of a character candidate by the universal classifier system to a predefined character groups known to be ambiguous (e.g., the pair "4" and "9" ...). The universal classifier system can be pre-programmed , for example, to always recognize that a "4" is a suspicious character because ... . (Pintsov, 3:55-60, 4:4-10)
E.	determining whether one of the secondary recognizers is associated with the shape index, and if so, selecting that secondary recognizer as a selected secondary recognizer and passing the chirograph to the selected secondary recognizer, the secondary recognizer returning a code point	One or more universal classifiers are applied to image data to generate a probable character (step 100). ... (Pintsov, 3:65 – 4:22)

Element D of claim 1 recites "providing the chirograph to the primary recognizer and receiving a shape index therefrom, the primary recognizer providing the shape index without making any decision as to whether that chirograph is of a set of easily confused chirographs." The sections of Pintov allegedly disclosing this element do not describe a primary recognizer providing a shape index without making any decision as to whether that chirograph is of a set of easily confused chirographs. Rather, Pintsov describes specialist classifiers configured to recognize characters belonging to predefined ambiguity classes and a universal classifier system that first determines that a character candidate does not belong to a predefined ambiguity class before outputting the character candidate. As described in Pintov, a group of characters belonging to a predefined ambiguity class are used to identify whether a candidate character is a suspicious character. Each specialist classifier is trained or built to distinguish only differences between characters belonging to distinct ambiguity classes. (See Col 3:15-25.) A suspicious character may belong to a distinct ambiguity class based on apparent size, the type of character, level of gray in the image of the character, styles of handwriting, or upon assignment of a character candidate by the universal classifier to a predefined character group known to be ambiguous. (See Col 3:50-60.)

In Pintsov's technique, a universal classifier first outputs a probable identity of a candidate character and a determination is then made as to whether the character is suspicious. (See Cols 3:47-50; 3:66-4:2.) In one example described in Pintsov, such a determination may be made by checking whether the candidate character belongs to a predefined character group known to be ambiguous. (See Col 3:57-60.) In such a case, Pintsov describes that a character may be pre-programmed to belong to a predefined

character group known to be ambiguous when it is known to be mistaken for another character within that same ambiguity class, (e.g. "4" and "9"). (See Cols 4:2-10; 3:57-60.) Thus to determine whether a candidate character is suspicious, the candidate character may be compared to any pre-programmed characters belonging to a predefined character group known to be ambiguous. However, nowhere in Pintsov is there a description of a universal classifier outputting a character without making any decision as to whether that chirograph is of a set of easily confused chirographs. Pintsov explicitly states that "a determination is then made as to whether the character is "suspicious" and then provides an example where candidate character "4" may be determined to be a suspicious character by finding it pre-programmed as a character belonging to the predefined character group or ambiguity class containing "4" and "9".

The particular sections of Pintsov allegedly disclosing this element describe instead determining a suspicious character based upon assignment of a character candidate by the universal classifier system to a predefined character group known to be ambiguous (e.g., the pair "4" and "9"; the group "I", "l", "1", etc.). In the context that Pintsov is explaining that the "universal classifier system can be pre-programmed to always recognize that a '4' is a suspicious character because it is often mistaken for a '9'", Pintsov is describing explicitly assigning the character "4" to the ambiguity class containing "4" and "9". Pintsov goes on to confirm this by concluding "[t]hus, the candidate character is part of the ambiguity class containing '4' and '9'".

Applicants respectfully submit that dependent claims 2-6, 19, 20 and claims 7-18, 21-27, by similar analysis, are not anticipated by Pintsov. Each of these claims include the limitations of a "without making any decision as to whether that chirograph is of a set

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of easily confused chirographs." As discussed above regarding claim 1, the sections of Pintov allegedly disclosing this element do not describe a primary recognizer providing a shape index without making any decision as to whether that chirograph is of a set of easily confused chirographs. Rather, Pintsov describes specialist classifiers configured to recognize characters belonging to predefined ambiguity classes and a universal classifier system that first determines that a character candidate does not belong to a predefined ambiguity class before outputting the character candidate.

II. *__The combination of Pintsov with Crane, Shimuzu and/or Guo is impermissible by law__*

For a combination of prior art references to render an invention obvious, there must be some reason, suggestion, or motivation found in the prior art whereby a person of ordinary skill in the field of the invention would make the combination. In re Oetiker, 977 F.2d 1443, 1447, 24 USPQ2d 1443, 1446 (Fed. Cir. 1992). A finding of obviousness on any other basis would constitute impermissible hindsight. See Interconnect Planning Corp. v. Feil, 774 F.2d 1132, 1143, 227 USPQ 543, 551 (Fed. Cir. 1985). Otherwise, combining prior art references without evidence of such a suggestion, teaching, or motivation simply takes the inventor's disclosure as a blueprint for piecing together the prior art to defeat patentability--the essence of impermissible hindsight. In re Dembiczak, 175 F.3d 994, 999, 50 USPQ2d 1614, 1617 (Fed. Cir. 1999).

In the present application, the Office action has essentially done what is not proper by law, and used applicants' teachings as a blueprint, using an (incorrectly) modified Pintsov for some of the claimed limitations, and, without any specific evidence of

motivation to combine, has hunted for other references that might supply the limitations present in the application but missing from Pintsov. Instead of presenting any specific evidence of motivation to combine, the Office action has only made conclusory statements that are wholly unrelated to the claims in order to allege obviousness. However, such broad conclusory statements regarding the teaching of multiple references, standing alone, are not evidence of obviousness. Id.

For example, in rejecting claims 19 and 22, the Office action refers to a single, final character recognition block (FIG. 1, element 17) that works with distance values and feature vectors, to illogically allege that this is a per-index unique secondary recognizer as claimed. In support, the Office action contends that it would be obvious to "use the writer specific feature vectors of Shimuzu to augment the system of Pintsov to increase the ratio of a character recognition system employing a universal recognition dictionary without requiring that special operations be performed before character recognition is performed on the handwriting of a new writer." Not only is such an allegation merely a broad, conclusory statement not found in the prior art of record or elsewhere, but even if true, it is wholly unrelated to the claimed subject matter of claims 19 and 22, which is essentially directed towards having a unique secondary recognizer for each shape index that may be output by the primary recognizer. In other words, at best Shimuzu appears to be able to recognize things differently per writer, not per shape index. For at least the foregoing reasons, claims 19 and 22 are clearly patentable over any permissible combination of Pintsov and/or Shimuzu. Reconsideration and withdrawal of the rejections of claims 19 and 22 is respectfully requested.

Moreover, regarding the combination of Pintsov with Guo, applicants note that Guo teaches away from any such combination, by teaching that its modified classification tree is a whole recognizer unto itself that provides many benefits over CART trees and neural networks. If anything, this would essentially lead an objective reader to conclude that there is no need for secondary recognition. In the specific example of handwriting recognition, Guo explicitly points out (at page 186, section 4.2) that "it is a 10 class problem to recognize the numbers 0 - 9," which is like the typical recognition attempts referred to in applicants' background section. Moreover, Guo separately tests his "CTNNFE" recognition method on samples against a neural network recognition method (see Guo, Fig. 4.2) and determines that his single classification tree method is superior in many ways to other methods, again leading the reader away from the present invention. Applicants reiterate that when prior art, in any material respect teaches away from the claimed invention, the art cannot be used to support an obviousness rejection. In re Geisler, 116 F.3d 1465, 1471, 43 USPQ2d 1362, 1366 (Fed Cir. 1997). Applicants respectfully request withdrawal of the §103(a) rejections of the claims based in any way on Guo.

Rejections Under 35 U.S.C. 112

The Examiner has rejected claims 1-27 under 35 U.S.C 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Applicants respectfully traverse these rejections. Applicants respectfully submit that claims 1, 7, 13 and 18

properly recite the limitation that the primary recognizer provides the shape index "without making any decision as to whether that chirograph is of a set of easily confused chirographs."

The Examiner misinterprets the sections of the specification allegedly describing that the primary recognizer makes decisions as to whether a chirograph is of a set of easily confused chirographs. Those decisions are not made by the primary recognizer at all, but to the extent they can be considered decisions, are made during the training process. During each actual recognition of a chirograph, the decision as to whether to use a secondary recognizer is not made by the primary recognizer, but is inherent by the existence or non-existence of a secondary recognizer for a code point. The specification states, "In accordance with one aspect of the present invention, as described in more detail below, those chirographs which often confuse a recognizer are provided to a secondary recognition process." As described above in the overview of applicants' technique, a primary recognizer is provided for converting chirographs to code points, and secondary recognizers are developed and trained to differentiate chirographs which produce selected code points. The output of *training* data from a primary recognizer may be used to construct secondary recognizers for each code point supported by the system. Using the training data, the primary recognizer returns a code point to a sorting process to sort the chirographs and actual code points into various files. Note that if other types of shape indexes are being used, the chirographs are similarly sorted into files for each shape index based on the shape index returned by the primary recognizer. A secondary recognizer may then be constructed for each of the files so that a secondary recognizer exists for each code point (or shape index) supported by the system. If the secondary

recognizer has only one possible output that is the same code point as output by the primary recognizer, or does not improve recognition accuracy, such a secondary recognizer may be discarded in applicants' technique since it does not improve recognition of the chirograph. Such a sorting process, as part of *training*, automatically discovers any chirographs that the primary recognizer tends to confuse whereby secondary recognizers constructed for each of these files are then inherently able to distinguish any chirographs that the primary recognizer has tended to confuse in training. Following training, when used to recognize an actual unknown chirograph, those chirographs that have characteristics similar to those training samples that tended to confuse the primary recognizer are thus distinguished by the secondary recognizers, without any decision made by the primary recognizer as to whether that chirograph is of a set of easily confused chirographs. This is well explained in the specification; any inability to understand applicants' invention is because of misinterpretations made by the Office action in the (failed) attempt to fit applicants' invention into Pintsov's very different teachings. Applicants respectfully submit that dependent claims 2-6, 8-12, 14-17 and 19-27, by similar analysis, are in condition for allowance.

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Conclusion

Based upon the above remarks, all of the pending claims are in condition for allowance. Applicant respectfully requests reconsideration of this application and its early allowance. If in the opinion of the Examiner a telephone conference would expedite the prosecution of the subject application, the Examiner is invited to call the undersigned attorney at (425) 836-3030.

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Respectfully submitted,

Albert S. Michalik

Albert S. Michalik, Reg. No. 37,395
Attorney for Applicants
Law Offices of Albert S. Michalik, PLLC
704 - 228th Avenue NE, Suite 193
Sammamish, WA 98074
(425) 836-3030
(425) 836-8957 (facsimile)

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